



# Semiconductor Optics

**Marcin L. Sadowski, Marek  
Potemski, Marian Grynberg**



## **Semiconductor Optics:**

*Semiconductor Optics* Claus F. Klingshirn, 2012-07-06 The updated and enlarged new edition of this book provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV It includes coverage of linear and nonlinear optical properties dynamics magneto and electrooptics high excitation effects some applications experimental techniques and group theory The mathematics is kept as elementary as possible The subjects covered extend from physics to materials science and optoelectronics New or updated chapters add coverage of current topics while the chapters on bulk materials have been revised and updated

**Semiconductor Optics** Claus F. Klingshirn, 1995-07-21 Semiconductor Optics provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV including linear and nonlinear optical properties dynamics magneto and electrooptics high excitation effects some applications experimental techniques and group theory Mathematics is kept as elementary as possible enough for an intuitive understanding of the experimental results and techniques treated The subjects covered extend from physics to materials science and optoelectronics

*Semiconductor Optics 1* Heinz Kalt, Claus F. Klingshirn, 2019-09-20 This revised and updated edition of the well received book by C Klingshirn provides an introduction to and an overview of all aspects of semiconductor optics from IR to visible and UV It has been split into two volumes and rearranged to offer a clearer structure of the course content Inserts on important experimental techniques as well as sections on topical research have been added to support research oriented teaching and learning Volume 1 provides an introduction to the linear optical properties of semiconductors The mathematical treatment has been kept as elementary as possible to allow an intuitive approach to the understanding of results of semiconductor spectroscopy Building on the phenomenological model of the Lorentz oscillator the book describes the interaction of light with fundamental optical excitations in semiconductors phonons free carriers excitons It also offers a broad review of seminal research results augmented by concise descriptions of the relevant experimental techniques e g Fourier transform IR spectroscopy ellipsometry modulation spectroscopy and spatially resolved methods to name a few Further it picks up on hot topics in current research like quantum structures mono layer semiconductors or Perovskites The experimental aspects of semiconductor optics are complemented by an in depth discussion of group theory in solid state optics Covering subjects ranging from physics to materials science and optoelectronics this book provides a lively and comprehensive introduction to semiconductor optics With over 120 problems more than 480 figures abstracts to each chapter as well as boxed inserts and a detailed index it is intended for use in graduate courses in physics and neighboring sciences like material science and electrical engineering It is also a valuable reference resource for doctoral and advanced researchers

**Semiconductor Optics and Transport Phenomena** Wilfried Schäfer, Martin Wegener, 2013-06-29

Whenever a physicist visits the physics faculty in Dortmund he she is bound to hear the success story of the so called integrated course a four semester introduction to physics These lectures are given by two professors simultaneously one

experimentalist and one theorist After having asked the common question How many professors have killed each other the visitor usually realizes that this is an excellent way of presenting a coherent introduction to both experimental and theoretical physics We decided to try this concept in an advanced course on semiconductor physics At that point the typical student has already had an introductory course in solid state physics and solid state theory The aim of the lectures was to repeat some of the most important well known classics of semiconductor optics and transport and eventually guide the students to topics of current interest in research When preparing the lectures we did not find a textbook addressing all these aspects experiment and theory in semiconductor optics and transport which made us write this book This book presents the phenomenology and a simple intuitive understanding of many effects and in addition attempts to explain the underlying physics on a consistent theoretical footing Calculations are presented such that a student should be able to follow them with a pencil and a piece of paper

**Semiconductor Optics** Claus F. Klingshirn, 1997-02-03 Semiconductor Optics provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV including linear and nonlinear optical properties dynamics magneto and electrooptics high excitation effects some applications experimental techniques and group theory Mathematics is kept as elementary as possible enough for an intuitive understanding of the experimental results and techniques treated The subjects covered extend from physics to materials science and optoelectronics

Optics of Semiconductors and Their Nanostructures Heinz Kalt, Michael Hetterich, 2013-04-09 In recent years the field of semiconductor optics has been pushed to several extremes The size of semiconductor structures has shrunk to dimensions of a few nanometers the semiconductor light interaction is studied on timescales as fast as a few femtoseconds and transport properties on a length scale far below the wavelength of light have been revealed These advances were driven by rapid improvements in both semiconductor and optical technologies and were further facilitated by progress in the theoretical description of optical excitations in semiconductors This book written by leading experts in the field provides an up to date introduction to the optics of semiconductors and their nanostructures so as to help the reader understand these exciting new developments It also discusses recently established applications such as blue light emitters as well as the quest for future applications in areas such as spintronics quantum information processing and third generation solar cells

Coherent Semiconductor Optics Torsten Meier, Peter Thomas, Stephan W. Koch, 2007-02-13 This book could not have been written without the extensive work of many diploma and Ph D students in our Theoretical Semiconductor Physics Group at the Philipps University in Marburg They have contributed to the fundamental understanding and to many applications in the area of coherent semiconductor optics The one dimensional tight binding model which is exclusively treated in the present book has been the basis of many of their diploma and Ph D theses The reader will find references to their results and also their names as authors of the publications listed in the sections Suggested Reading In particular the authors wish to thank Irina Kuznetsova who prepared a large number of the figures and recalculated the underlying data on the basis of the equations

presented in this book in cases where parameters or presentation had to be changed and or optimized Some of the problems in particular those connected to the more introductory chapters were solved by Swantje Horst and Joachim Kalden They made valuable suggestions for improved formulation of the problems and pointed out a number of hints we should give our readers in order to help them with the solutions Furthermore we wish to thank all our numerous collaborators together with whom we have performed research in the area of coherent semiconductor optics in the past and present for many valuable discussions In particular without the close cooperation between experiment and theory this research would not have advanced to the present level

Semiconductor Optics 2 Heinz Kalt, Claus F. Klingshirn, 2024-03-16 This book provides an introduction to and an overview of the multifaceted area of dynamics and nonlinearities related to optical excitations in semiconductors It is a revised and significantly extended edition of the well established book by C Klingshirn split into two volumes and restructured to make it more concise Inserts on important experimental techniques reference to topical research and novel materials as well as consideration of photonic applications support research oriented teaching and learning This book reviews nonlinear optical properties and many body phenomena evoked by high densities of quasi particles in semiconductors Coherent dynamics and relaxation of optical excitations carriers excitons electron hole plasmas etc as well as condensation phenomena are elucidated in these materials A broad overview is provided of seminal research results augmented by detailed descriptions of the relevant experimental techniques e g ultrafast spectroscopy four wave mixing and the Hanbury Brown and Twiss experiment Offering a comprehensive introduction to hot topics in current research polariton condensates valley coherence and single photons to name a few it also discusses applications of the described physical concepts in topical areas such as quantum information photonics spintronics and optoelectronics Covering subjects ranging from physics to materials science and optoelectronics the book provides a lively and comprehensive introduction to semiconductor optics beyond the linear regime With many problems chapter introductions schematic depictions of physical phenomena as well as boxed inserts and a detailed index it is suitable for use in graduate courses in physics and neighboring sciences like material science and optical communication It is also a valuable reference resource for doctoral and advanced researchers

Optical Properties and Applications of Semiconductors Inamuddin, Mohd Imran Ahamed, Rajender Boddula, Tariq Altalhi, 2022-07-18 Semiconductors with optical characteristics have found widespread use in evolving semiconductor photovoltaics where optical features are important The industrialization of semiconductors and their allied applications have paved the way for optical measurement techniques to be used in new ways Due to their unique properties semiconductors are key components in the daily employed technologies in healthcare computing communications green energy and a range of other uses This book examines the fundamental optical properties and applications of semiconductors It summarizes the information as well as the optical characteristics and applicability of semiconductors through an in depth review of the literature Accomplished experts in the field share their knowledge and examine new

developments FEATURES Comprehensive coverage of all types of optical applications using semiconductors Explores relevant composite materials and devices for each application Addresses the optical properties of crystalline and amorphous semiconductors Describes new developments in the field and future potential applications Optical Properties and Applications of Semiconductors is a comprehensive reference and an invaluable resource for engineers scientists academics and industry R D teams working in applied physics *Optical Properties of III-V Semiconductors* Heinz Kalt,2012-12-06 Optical and electronic properties of semiconductors are strongly influenced by the different possibilities of carriers to be distributed among the various extrema of the band structure or the transfer between them The monograph Optical Properties of III V Semiconductors is concerned with the III V bulk and low dimensional semiconductors with the emphasis on the implications of multi valley bandstructures on the physical mechanisms essential for opto electronic devices The optical response of such semiconductor materials is determined by many body effects like screening gap narrowing Fermi edge singularity electron hole plasma and liquid formation The discussion of the latter features is presented self consistently with the dynamics of excitons and carriers resulting from intervalley coupling **Fundamentals of Photonics** Bahaa E. A. Saleh,Malvin Carl Teich,2020-03-04 Fundamentals of Photonics A complete thoroughly updated full color third edition Fundamentals of Photonics Third Edition is a self contained and up to date introductory level textbook that thoroughly surveys this rapidly expanding area of engineering and applied physics Featuring a blend of theory and applications coverage includes detailed accounts of the primary theories of light including ray optics wave optics electromagnetic optics and photon optics as well as the interaction of light and matter Presented at increasing levels of complexity preliminary sections build toward more advanced topics such as Fourier optics and holography photonic crystal optics guided wave and fiber optics LEDs and lasers acousto optic and electro optic devices nonlinear optical devices ultrafast optics optical interconnects and switches and optical fiber communications The third edition features an entirely new chapter on the optics of metals and plasmonic devices Each chapter contains highlighted equations exercises problems summaries and selected reading lists Examples of real systems are included to emphasize the concepts governing applications of current interest Each of the twenty four chapters of the second edition has been thoroughly updated **Handbook Of Carbon Nano Materials (In 2 Volumes) - Volume 3: Medicinal And Bio-related Applications; Volume 4: Materials And Fundamental Applications** Karl M Kadish,Francis D'souza,2012-05-15 A hands on reference guide for scientists working in the area of medicine biology chemistry physics materials science sensor and biosensor devices and nanotechnology The first volume compiles topics from leading authors on medicinal and bio related applications while the second volume covers topics ranging from materials and fundamental applications In depth and comprehensive coverage of topics combined with the perspectives for future research by the contributing authors An invaluable reference source essential for both beginning and advanced researchers in the field **Handbook of Carbon Nano Materials** Francis D'Souza,Karl M. Kadish,2011 1

Functionalization of graphene Nikolaos Karousis Solon Economopoulos and Nikos Tagmatarchis 2 Advanced carbon materials for electrochemical energy conversion and storage Junbo Hou und weitere 3 Carbon nanomaterial based molecular architectures for light energy conversion Taku Hasobe 4 Electrochemistry of carbon nanostructures from pristine materials to functional devices Matteo Iurlo und weitere 5 Fullerene based self assembled morphological materials Yanfei Shen Junko Aimi and Takashi Nakanishi 6 Hybrids involving fullerenes and carbon nanotubes Maria Vizuite und weitere 7 Semiconductor carbon nanotube optics Lisa J Nogaj Libai Huang and Todd D Krauss 8 Near field optics of SWNTs and FRET in their nanoscale complexes Tetyana Ignatova Andrei M Nemilentsau and Slava V Rotkin 9 Understanding the role of the metal catalyst in carbon nanotube growth towards chiral selective growth of single walled carbon nanotubes Wei Hung Chiang and R Mohan Sankaran 10 Stability computations for fullerenes and metallofullerenes Zdenek Slanina und weitere

**Medicinal and Bio-Related Applications** Francis D'Souza, Karl M. Kadish, 2012 A hands on reference guide for scientists working in the area of medicine biology chemistry physics materials science sensor and biosensor devices and nanotechnology The first volume compiles topics from leading authors on medicinal and bio related applications while the second volume covers topics ranging from materials and fundamental applications In depth and comprehensive coverage of topics combined with the perspectives for future research by the contributing authors An invaluable reference source essential for both beginning and advanced researchers in the field

**Introduction to Semiconductor Optics** Nasser Peyghambarian, Stephan W. Koch, Andre Mysyrowicz, 1993 *Quantum Theory of the Optical and Electronic Properties of Semiconductors* Hartmut Haug, Stephan W. Koch, 2004 This invaluable textbook presents the basic elements needed to understand and research into semiconductor physics It deals with elementary excitations in bulk and low dimensional semiconductors including quantum wells quantum wires and quantum dots The basic principles underlying optical nonlinearities are developed including excitonic and many body plasma effects Fundamentals of optical bistability semiconductor lasers femtosecond excitation the optical Stark effect the semiconductor photon echo magneto optic effects as well as bulk and quantum confined Franz Keldysh effects are covered The material is presented in sufficient detail for graduate students and researchers with a general background in quantum mechanics

Optical Properties of Semiconductor Nanostructures Marcin L. Sadowski, Marek Potemski, Marian Grynberg, 2000-06-30 Optical methods for investigating semiconductors and the theoretical description of optical processes have always been an important part of semiconductor physics Only the emphasis placed on different materials changes with time Here a large number of papers are devoted to quantum dots presenting the theory spectroscopic investigation and methods of producing such structures Another major part of the book reflects the growing interest in diluted semiconductors and II IV nanosystems in general There are also discussions of the fascinating field of photonic crystals Classical low dimensional systems such as GsAs GaAlAs quantum wells and heterostructures still make up a significant part of the results presented and they also serve as model

systems for new phenomena New materials are being sought and new experimental techniques are coming on stream in particular the combination of different spectroscopic modalities

**Semiconductor Integrated Optics for Switching Light** Charlie Ironside, 2017-09-12 This book covers the technology of switching or modulating light in semiconductor optical waveguides Currently a key function for optical communications systems is the conversion of data from an electrical signal to an optical signal for transmission in very low loss optical fibres and the converse process of optical to electrical conversion the O E O data conversion This conversion between electronic and photonic signals imposes an energy consumption overhead on optical communication systems So many research workers have been attracted to ultrafast all optical switching of data in different formats As a way of introduction to all optical switching in semiconductor waveguides the book covers the electro optic effect electroabsorption and electrorefraction effects that can be used in semiconductor optical modulation devices But the book focuses on all optical switching using second and third order optical nonlinearities in AlGaAs optical waveguides It covers a variety of device configurations including integrated nonlinear couplers and Mach Zehnder interferometers Further it provides design software in suit of Mathematica notebooks that can be used to explore the device design

光の半導体集積回路 (Japan), 1990 *Optical Spectroscopy of Semiconductor Nanostructures*

Eougenious L. Ivchenko, 2005 This volume looks at optical spectroscopy of semiconductor nanostructures Some of the topics it covers include quantum confinement in low dimensional systems resonant light reflection and transmission and absorption



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